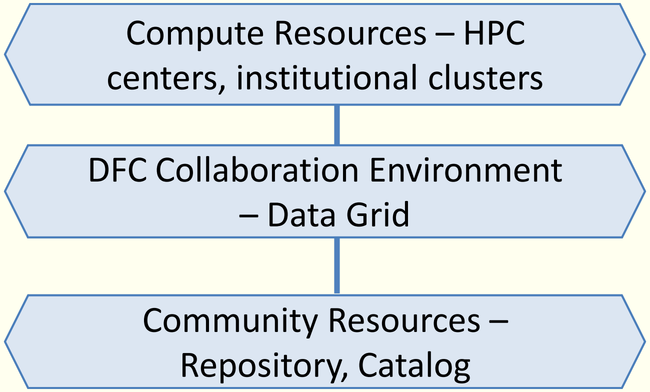
NSF OCI: #0940841 DataNet Federation Consortium

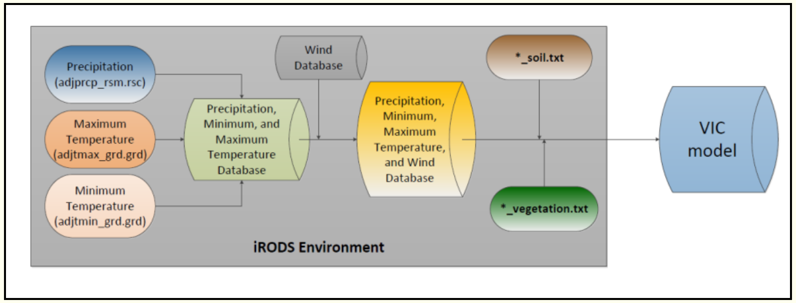
- Enable collaborative research
  - Sharing of data, information, and knowledge
- Build national data cyberinfrastructure
  - Federation of existing data management systems
- Support reproducible data-driven research
  - Encapsulate knowledge in shared workflows
- Enable student participation in research
  - Policy-controlled access to “live” data



Compute Resources – HPC centers, institutional clusters

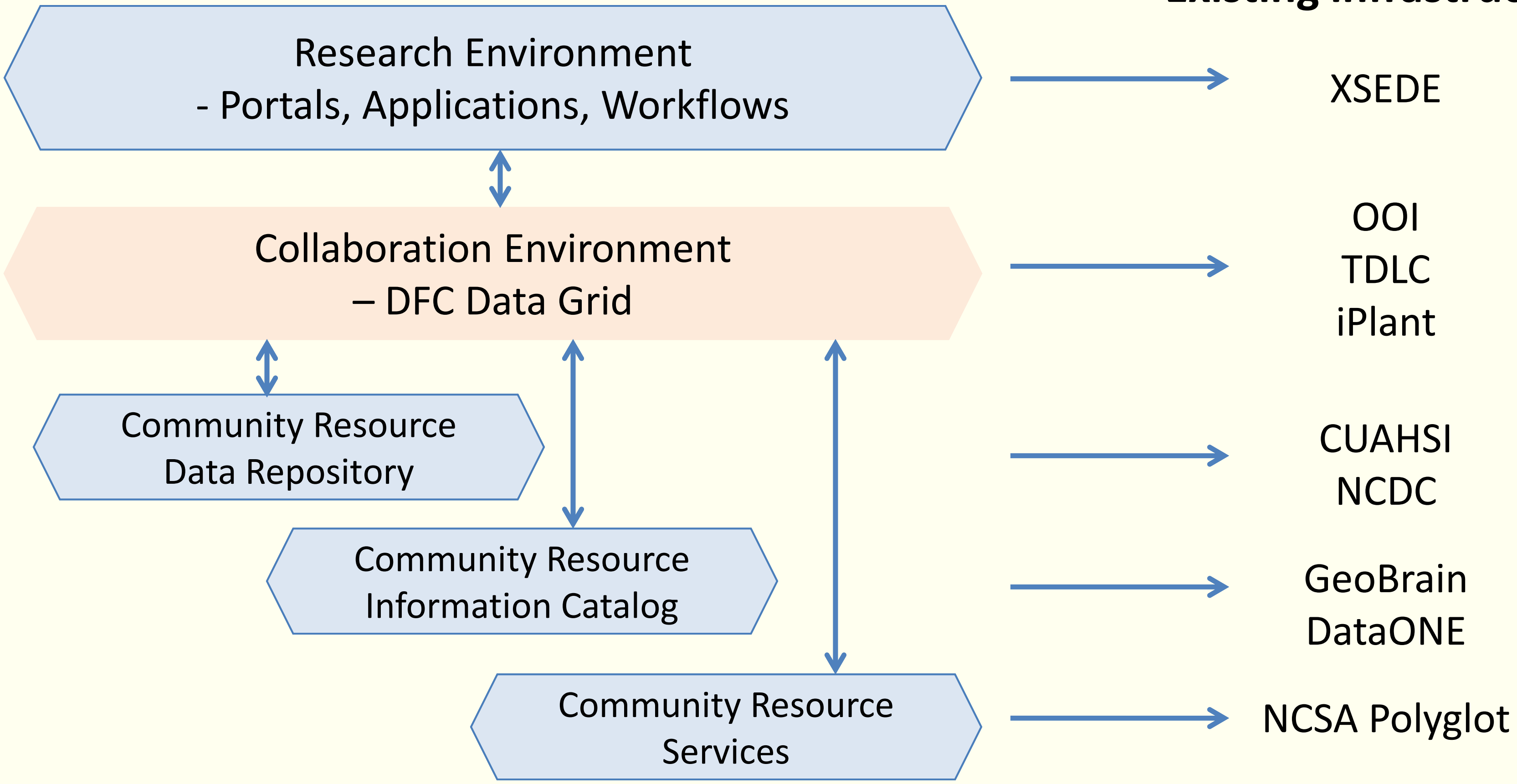
DFC Collaboration Environment – Data Grid

Community Resources – Repository, Catalog


Precipitation (adjprcp_rsm.rsc)
Maximum Temperature (adjtmax_grd.grd)
Minimum Temperature (adjtmin_grd.grd)
Wind Database
Precipitation, Minimum, and Maximum Temperature Database
Precipitation, Minimum, Maximum Temperature, and Wind Database
*_soil.txt
*_vegetation.txt
VIC model
iRODS Environment

Lifetime Library

National Infrastructure



Existing infrastructure

Research Environment
- Portals, Applications, Workflows

Collaboration Environment
– DFC Data Grid

Community Resource
Data Repository

Community Resource
Information Catalog

Community Resource
Services

XSEDE

OOI
TDLC
iPlant

CUAHSI
NCDC

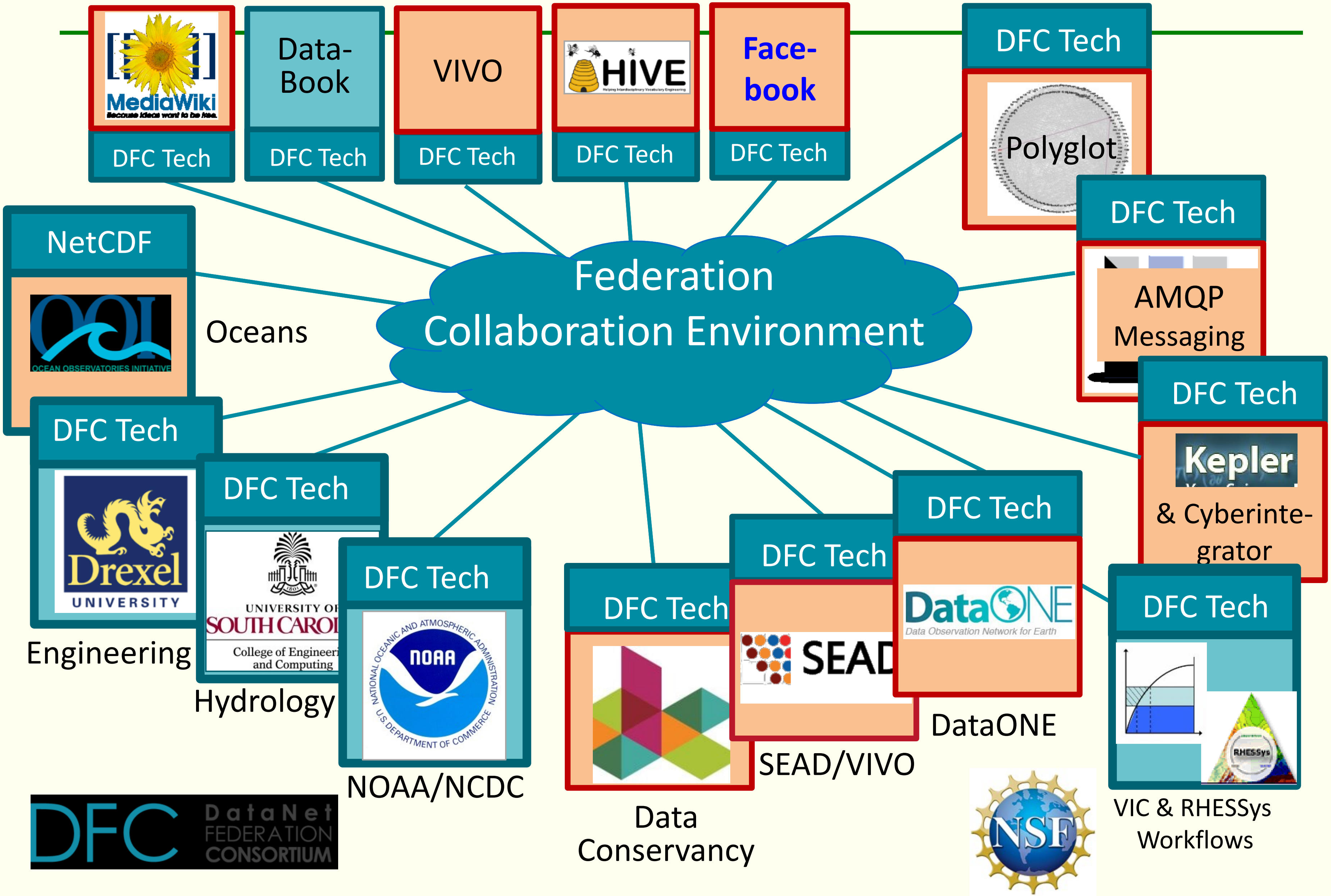
GeoBrain
DataONE

NCSA Polyglot

NSF DataNet Federation Consortium

Enabling Collaboration through Interoperability

DFC iRODS-based middleware enables interoperability between heterogeneous clients, data, and service resources



Federation Collaboration Environment

MediaWiki — DFC Tech

Data-Book — DFC Tech

VIVO — DFC Tech

HIVE — DFC Tech

Face-book — DFC Tech

DFC Tech — Polyglot

DFC Tech — AMQP Messaging

DFC Tech — Kepler & Cyberintegrator

NetCDF — OOI — Oceans

DFC Tech — Drexel University — Engineering

DFC Tech — University of South Carolina College of Engineering and Computing — Hydrology

DFC Tech — NOAA — NOAA/NCDC

DFC Tech — Data Conservancy

DFC Tech — SEAD — SEAD/VIVO

DFC Tech — DataONE — DataONE

DFC Tech — RHESSys — VIC & RHESSys Workflows

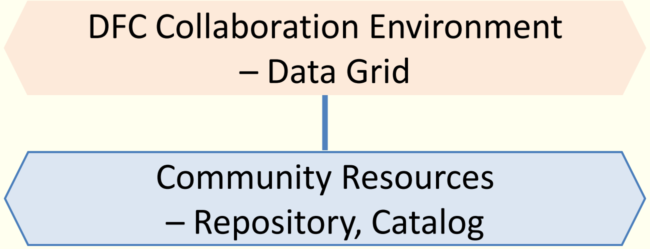
Data Observation Network for Earth
OCEAN OBSERVATORIES INITIATIVE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

DFC DataNet FEDERATION CONSORTIUM

NSF

Practitioners' Perspective

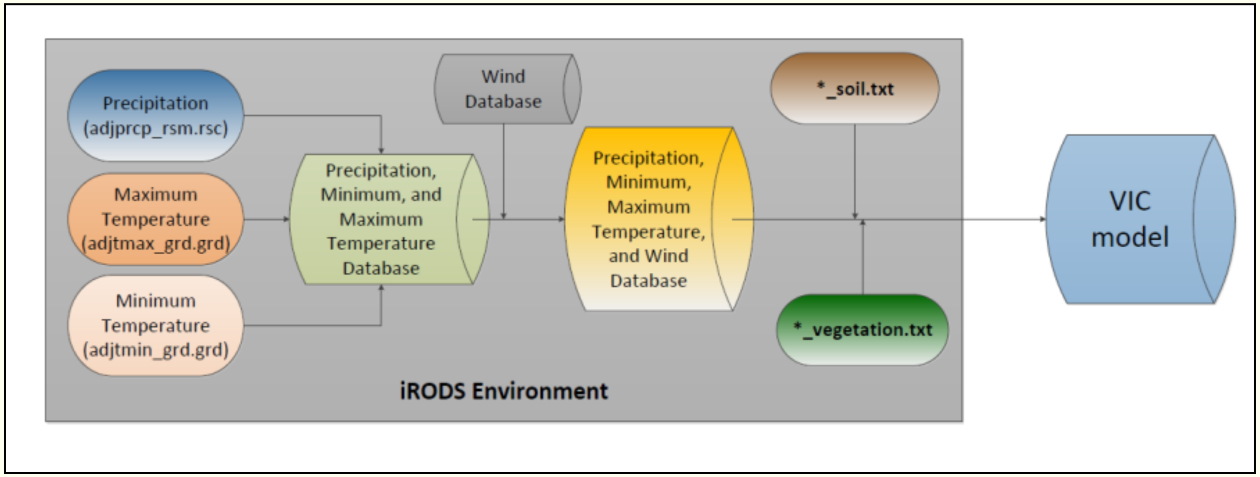
- Build community resource
  - Address explicit purpose for formation of a collaboration
  - Build community consensus on provenance, descriptive, system metadata
  - Capture domain knowledge (procedures for interoperability, research analyses, management)
  - Share data, procedures, workflows



DFC Collaboration Environment – Data Grid

Community Resources – Repository, Catalog

- Enable reproducible data-driven research through workflows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VIC model
iRODS Environment

Challenges

- DFC uses iRODS policy-based data grid to handle:
  - Acquisition of all relevant data for research
    - Develop micro-services that can access external repositories
  - Distribution of data management effort
    - Use data grid to automate replication of data between agencies
  - Automation of the application of domain knowledge
    - Share workflows used in research analyses
  - Management of policies for data control
    - Enforce policies at each storage location

1. Metadata virtualization (manage properties of metadata – creation time, storage location, access controls, schema)
2. Knowledge virtualization (manage processes that generate metadata – provenance, descriptive, administrative)

iRODS Policy-Based Data Management

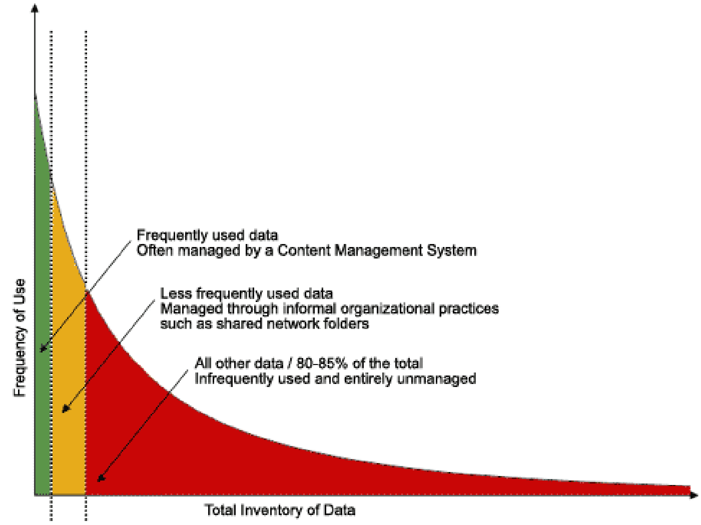
- ***Purpose*** - reason a collection is assembled
- ***Properties*** - attributes needed to ensure the **purpose**
- ***Policies*** - rules to enforce and maintain collection **properties**
- ***Procedures*** - functions that implement the **policies**
- ***Persistent state information*** – metadata from applying the **procedures**
- ***Property assessment criteria*** – validation that **state information** conforms to the desired **purpose**
- ***Federation*** - controlled sharing of **logical name spaces**

- We capture domain knowledge in policies and procedures, and evolve policies to implement data life cycle stages
- Broadening of impact corresponds to evolution of policies to represent consensus of a new larger community

NSF Data Bridge: Solving the First & Last Mile Problems in Big Data

First Mile: Bring the Long-tail of Science Data into Mainstream

Last Mile: Automate Linking, Clustering, and Discovery of Interesting Relationships in Heterogeneous Data



Data Bridge: NSF-funded Big Data Project

–Apply Socio-metric Network Analysis (SNA) to data

–Explore Relationships between Data, Users, Resources, Methods, Workflows, …

–Link through Multi-dimensional vectors

- Similar to, but for data: LinkedIn YouTube TAGGED

–Incentives:

- Enable participation in a larger collaboration
- Raise awareness of local data and bring low value per byte data into shared collections

More Information

- DataNet Federation Consortium
  - http://datafed.org
  - UNC-CH, UCSD, Drexel, USC
- Integrated Rule Oriented Data System (iRODS)
  - http://irods.diceresearch.org
  - Application of data grids include
    - NOAA National Climatic Data Center
    - NASA Center for Climate Simulations
    - French National Library
    - Broad Institute genomics data grid
    - International Neuroinformatics Coordinating Facility